



Protocol for the Incineration of
Polychlorinated Biphenyls at
St. Lawrence Cement Company,
Mississauga

ARB-TDA-21-80

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Ministry
of the
Environment

The Honourable
Harry C. Parrott, D.D.S.,
Minister

Graham W. S. Scott, Q.C.,
Deputy Minister

Protocol for the Incineration of
Polychlorinated Biphenyls at
St. Lawrence Cement Company, Mississauga

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October 17, 1979
Amended October 30, 1979
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Amended October 30, 1979
Pages 12 and 18

Amended March 27, 1980
Pages 18, 18 a, and 18 b

INTRODUCTION

At the end of 1975 and extending into January 1976, experimental work was carried out on the burning of polychlorinated biphenyls (PCBs) in the No. 1 kiln at St. Lawrence Cement Company.

Earlier trials of burning chlorinated hydrocarbons in a dry process kiln had indicated that satisfactory destruction of these compounds could be achieved. The No. 1 kiln in which the 1976 tests were made is a wet process kiln.

These early tests have shown that virtually complete destruction of the PCBs was possible at PCB feed rates of between 0.5 and 5.7 kg/min. The sampling and analytical methods used for emission testing were unable to detect PCBs in the effluent gas stream at the concentrations for which they were designed. The stack gas concentrations were less than 160 $\mu\text{g}/\text{m}^3$ and probably less than 3 $\mu\text{g}/\text{m}^3$. The higher values could conceivably have existed if "noise" apparent on the chromatographic separation detectors were construed as incipient detection of PCBs.

No high molecular weight compounds were detected; neither could chlorobenzene or decachlorobiphenyl, which were the most probable heavier molecules to survive the incineration process, be identified.

Since that time, improvements in the sampling and analytical methods, and the development of direct measurement techniques in the mass spectrographic device, the TAGA 3000, have made more rapid, yet sensitive determinations possible.

Small amounts of low molecular weight chlorinated compounds tentatively identified as carbon tetrachloride,

chloroform and dichloromethane were reported at levels of less than 30 ppb.

A chlorine balance was attempted across the kiln, but could not be achieved either during the incineration of wastes or during normal kiln operation. There is evidence that chlorides concentrate in the deposits and rings formed inside the kiln, and are deposited in the interstices of the kiln lining, and between the lining and kiln shell. Analysis of the deposits indicate high chlorine contents but quantification is not possible. The absence of a satisfactory balance cannot be considered to be indicative of incompleteness of destruction since even a "good" balance would be subject to variations in excess of the potential losses in the exhaust gases.

The analytical and sampling techniques available for PCBs at the time of trial required extended sampling times in order to achieve suitable sensitivity and accuracy. The present potential availability of analytical methods using the TAGA, with much greater sensitivity, may permit the detection of homologous groups of PCBs in the effluent gas stream, at the level of about 10 ng/m^3 each, on a rapidly repetitive basis. Each group comprising several compounds with the same molecular weight, requires slightly more than one minute for the analysis.

Greater sensitivity of the emission analyses is considered to be desirable and further analyses of ambient air are felt to be necessary. The current trial was therefore planned to recheck and improve upon the earlier test, and at the same time to test the TAGA under operational conditions, checking its capability and comparing the result with those obtained by other means.

Sampling the stack gases at higher rates, extending the ambient air sampling and using the more sensitive analytical tool, the TAGA 3000, should provide more sensitive and more reliable test results.

The test will be conducted using the No. 1 kiln at St. Lawrence Cement Company's plant in Mississauga. A major aim of the trial will be to obtain the result in a safe manner.

In addition to the monitoring of kiln operating conditions, to ensure the virtually complete destruction of PCBs, the stack emission measurements and meteorological assessments will be used to predict ground level concentrations.

The incineration of PCBs will be stopped by shutting off the PCB feed whenever kiln operating conditions are upset, when stack concentrations of total PCBs exceed 20 micrograms per cubic metre, and when ground level concentrations are predicted to exceed 2.5 nanograms per cubic metre. Under normal atmospheric conditions, the existence of 20 micrograms/cubic metre in the emissions will not give rise to concentrations in excess of 2 nanograms per cubic metre (Appendix C). Should unusual atmospheric conditions such as fumigations exist or be predicted, additional detailed calculations pertinent to the specific situation will be made to predict probable ambient air concentrations.

A guideline concentration for ambient air quality, of 150 ng/m^3 (24-hour average) has recently been established for PCBs. This was based on criteria for the protection of human health. This has been related to an annual guideline of 35 ng/m^3 (yearly average) and a point of impingement standard of 450 ng/m^3 (1/2-hour average).

Against these levels a half hour predicted average of 2.5 ng/m^3 is negligible and will be within the normal range of variation of the measured concentrations at Mississauga.

Material for Incineration

St. Lawrence Cement Plant will acquire the raw materials for the trial. It is at present anticipated that the material will be of relatively clean liquids obtained from General Electric Company (GEC) and Westinghouse Canada Ltd., diluted with available waste oils, free from PCBs, to a chlorine content of 10%. Transport of the materials to the St. Lawrence Cement site will be by commercially operated tanker. The tanker will be cleaned after use by successive rinsings with a solvent which will be put to storage for subsequent burning.

Blending of materials will be carried out initially at the supplying source to give concentrations of the desired level, and the total of 4 tanker loads received will be finally blended in the receiving storages by circulation of the liquors.

At the blending locations arrangements will be made to seal the drains serving the blending areas which will be dyked, where necessary, to ensure that spillages are not allowed to overflow to other areas where damage can be caused.

The receiving storage facilities will be overhauled prior to receipt of the liquors, to ensure that the pipe joints, valve and pump glands are leak tight, and the packing is in good condition.

The storage vent will be vented to a carbon treatment system to collect the PCBs from the gases displaced during transfer operations.

Should spillages nevertheless occur, potential damage to local water courses, and nuisances to neighbouring areas could ensue. In order to avoid these effects, the area

around the storages and pumping facilities has been dyked; further damming will be undertaken of ditches and creeks, in which spills could collect, and which could lead the spilled liquids off the plant premises.

The company will initiate a procedure by which spillages will be reported immediately, by radio, to a man designated to inform the Ministry of the Environment. Steps will be taken at once to halt the spillage and to prevent adverse effects. Any contaminated soil or equipment will be treated or disposed of in a manner acceptable to the Ministry.

Kiln Operation

The production of good quality cement clinker requires that wet process kiln conditions be maintained at a steady state in which the feed slurry is dried, calcined and finally clinkered during its passage through the kiln. To achieve this result, specific combustion gas flow, temperatures and compositions are necessary. These conditions are such that they offer the best opportunity available in a kiln for the combustion of PCBs to be carried out to effective completion. Control of the kiln must therefore be such as to maintain those conditions and to stop the feeding of PCBs when they are not maintained.

The material and content of the kiln and the amount of energy carried by the contents are large. They form a reservoir of heat and materials which minimize the rate of change of the kiln conditions. Temperatures fall slowly even if fuel feed is halted, changes of gas composition and air flow rates caused by the normal control fluctuations occur at rates which permit manual shut off of the PCB feed should it become necessary before conditions are so badly disturbed as to result in noticeable changes in emission concentrations. The presence of teams of consultants for test purposes, the use of rapid analytical techniques and the close supervision such a test will be given ensures that rapid response to any process disturbance will be possible.

At the temperatures existing in the kiln, a residence time of 2 seconds is considered to be a desirable minimum. The kiln actually supplies a residence time in excess of 4.5 secs.

hence, minor temperature fluctuations are unlikely to have adverse effects.

In this test, the maximum value of PCB feed is established by the characteristics of the feed pump and the concentration of PCBs in the feed stock. It is limited to a maximum flow rate of 4 gallons per minute, hence, a feed concentration of chlorine restricted to 10%, ensures that a feed of 5 lb/min of chlorine will not be exceeded. This limit is that required to limit ring formation.

The need to ensure that adequate conditions for virtually complete incineration exist, requires that the following minimum operating conditions be maintained:

Clinker temperature in burning zone	1370°
Flame temperature	1700°C
Oxygen content of exhaust gas	0.2 - 1.5%
Combustibles in exhaust gas	N.D.

If the last of these requirements is not met, it does not indicate the presence of unburnt PCBs being emitted but could indicate inadequate combustion occurring and, hence, the possibility of a deterioration of the kiln conditions and subsequent PCB emissions occurring after a period of time.

To guard as far as possible against the likelihood of "puffing" occurring, the power consumption of the kiln will be monitored. An increase in power consumption indicates ring formation in the kiln. Such buildups are generally associated with the presence of alkali chloride due to high chlorine content of the feed or fuel. Power consumption increases would therefore be indicative of the need to reduce waste oil feed.

An idiosyncrasy of cement kilns is that of "puffing" with a (very slight) potential for PCB emission at the kiln product exit end. Since the gases emitted are unlikely to have contacted PCBs, which are injected into the flame zone further "down" the gas stream, there is only a very slight chance that they are contaminated. However, to test this supposition, monitoring of plant air near the burner end of the kiln will be undertaken, while sampling of the clinker cooler exhaust stack will further offer an indication if PCBs perchance do become entrained in the clinker, and be subsequently released to the clinker cooler gas stream.

Monitoring of the PCB stream will be by means of a meter located on the kiln floor; if clean feed can be obtained, a simple rotameter will be used. If the feed stock is unsuitable for visual flow indication, then a suitable meter will be chosen, probably a vortex shedding meter, to avoid problems with deposits.

Operation of the kiln will be the responsibility of St. Lawrence personnel who will also be responsible for some sample collections at a frequency specified in the following section.

Sampling Programme

The purpose of this trial burning of PCBs is to ensure that virtually complete destruction can be satisfactorily carried out in a cement kiln and to use the more sophisticated technology now available to assess more accurately the capability of a cement kiln to destroy PCBs.

Previous trials indicate that:

- a) better than 99.94% destruction can be achieved, and probably much better than that;
- b) a material balance for chlorine across the kiln cannot be satisfactorily achieved. An apparent loss of chlorine occurs.

Since reasons for the apparent loss of chlorine are known, deposition of chlorides within the kiln lining and accumulation in rings, no attempt will be made to close that balance. The main objective of ensuring the complete destruction of PCB's admitted as an auxiliary fuel, will be examined through the sampling and analysis programme.

A table of samples to be taken, the frequency, blending and analyses to be performed follows.

Blending, mixing and where necessary, extraction of the samples, will be carried out by the stack sampling consultant who will label the samples prior to submission to the Ministry of Environment laboratory for analyses.

An exception to this is taking of samples of feed PCB material for which special arrangements will be made. The handling subsequently will however remain the responsibility of the consultant.

The samples will be collected in prepared "PCB" bottles obtained from the MOE laboratory, due care being taken to avoid cross contamination and contamination from other sources such as the use of greases or plastics, which must not be used.

	Sampling Locations	Sample Point No.	Frequency of Sampling	Analyses Required
1	Water supply		1/Shift	Retain Cl^- , PCB if needed
2	Feed meal (dry)		3/Shift	Retain Cl^- , PCB if needed
3	Feed slurry weir		1/Shift blended daily	H_2O , Cl^- , PCB
4	Coal feed		1/Shift blended daily	Retain Organic Cl if needed
5	PCB waste oil storage		1 only blended from tankers	PCB Total Organic Cl, Cl^-
6	PCB waste oil feed line		2 hourly blended daily	PCB Total Organic Cl, Cl^-
7	ESP discard dust		2/Shift blended daily	PCB
8	ESP return dust		2/Shift blended daily	PCB
9	Clinker Cooler crusher outlet		1/Shift blended daily	PCB
10	Clinker Exhaust filter gravel		1/day	Retain
11	Clinker Exhaust gas		1/day	TSP, PCB, Hexachlorobenzene
12	Main Stack Exhaust		1/day continuous	TSP, PCB, Hexachlorobenzene PCB by TAGA 3000
13	Plant Air at Kiln burner floor		continuous Nutech sampling daily six sites	PCB

Stack Sampling

The sampling of the stack emissions will be carried out by consultant companies, but in the case of the contractor employed to sample by standard methods, analyses will be carried out on aliquots of the collected materials by the Ministry of the Environment laboratories using a "perchlorination" method and mass spectrometric speciation.

The standard method of stack sampling to be used is given in the Work Statement for "Measurement of PCB and Hexachlorobenzene Emissions from Cement Kiln #1 at the St. Lawrence Cement Plant in Clarkson" (Appendix A). This method uses well tested techniques for the sampling and analysis of stack emissions including gas flow rates, particulate concentrations and PCB concentrations.

In addition, continuous analyses will be made using the TAGA 3000 in which the concentrations of (species of) chlorinated biphenyls will be determined. The procedures used for these analyses is described in Appendix 3.

Prior to the trial burn, the sampling line and the TAGA 3000 will be tested and calibrated by the injection of known quantities and concentrations of PCB's into the sample inlet while metered samples of normal stack gases are withdrawn from the stack for analysis. During this period no PCB's will be introduced into the kiln with the fuel.

Stack gas tests by both methods will also be carried out before and after the trial burn to determine the levels existing in the exhausts. There is some possibility

that PCB's are admitted to the exhaust gas from water used to mix the feed slurry. Any PCB's introduced in this way are not subject to the incineration conditions existing in the kiln burning section, but are likely to be evaporated from the slurry along with the water as it is driven off in the drying zone.

Feed water samples will therefore also be examined for the presence of PCB's.

Ambient Air Sampling

The programme of sampling for ambient air quality is given in the Phase III Work Statement, "Fall Mississauga Survey" (Appendix 2) and will cover periods before, during and after the last burn; a total of 13 days.

A meteorological support tower will be available in the vicinity to monitor weather conditions.

The contractor carrying out the ambient air sampling will be responsible for obtaining the hourly meteorological data.

This data will be used along with information from established meteorological stations for correlation with the analytical reports, and to predict weather conditions, which will in turn be used to assess the probable increases in ambient concentrations due to stack emissions.

Process Sampling

The sampling of process materials will be carried out in accordance with Table 1. With the exception of the PCB feed stream, which has a high PCB concentration, samples will be taken by the St. Lawrence personnel and passed to the stack sampling consultant for compositing and extracting. The extracts will then be analysed by the Ministry of the Environment laboratory.

The PCB feed will be sampled by M.O.E. staff in order to avoid cross contamination of the remaining process samples. Blending and extraction will be done by the contractor.

In-Plant Air Sampling

The possibility of emissions of PCBs into the plant air around the fuel burning end of the kiln could conceivably arise from leaks on the metering and feed control manifold, or from puffing of the kiln. The chances appear to be slight, however, in order to test this, samples of plant air will be taken from 6 sites in the neighbourhood of the kiln clinker cooler. Three sites on either side of the kiln, one beside the feed manifold, one between the manifold and the kiln/cooler seal, and one beyond the seal, will be chosen and six Nutech samplers installed. Each sampler cartridge will be replaced at 24 hour intervals during the trial period, the withdrawn cartridge being capped and submitted for analysis.

Date and Duration of Trial

The PCB storage tank will hold a maximum of 22,000 gallons of feed stock, and the feed pump output is limited to 4 gallons per minute, the total duration of the test will therefore be limited to a maximum of 3 1/2 days. The trial will be divided into two segments. The first will comprise a 24-hour burn at 4 gal/min. after which key samples will be analysed, process and operating data will be received and the TAGA 3000 results will be scanned. If the evidence shows that the operation is being successfully managed and the PCB emissions do not exceed the design limits, a further burn will follow during which the remaining PCB's will be incinerated. It is anticipated that the initial one day run will occur on a Tuesday, the results will be available and all assessed by the following Tuesday and the trial completed during the subsequent Wednesday and Thursday,

Both before and after the test burn, samples will be taken and analysed to provide basic data against which the results of the trial can be assessed.

The starting date cannot be definitely assigned until management approval for the trial is received: this approval will be dependent upon satisfactory establishment of the TAGA 3000 and its sampling system and on suitable atmospheric temperatures and weather conditions for operating the PCB feed system becoming established.

It is anticipated that mid to late April will be the period when approval will be received.

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For reference purposes the date of Tuesday, April 15th is provisionally taken as the starting date. The actual starting time may be earlier or later.

TIME TABLE

ACTIVITY	DATE	AUG.	SEPT.	OCT.	MARCH	APR.	MAY	JUNE	JULY
		4 11 18 25	1 8 15 22 29	6 13 20 27	1 8 15 22 29	5 12 19 26	3 10 17 24 31	7 14 21 28	5 12 19 26
Stack Test RFP	Issue Accept		ISSUED AND ACCEPTED	OCTOBER 1979					
Ambient Air Sampling RFP	Issue Accept		ISSUED AND ACCEPTED	OCTOBER 1979					
Pre-burn Analysis	Coal Feed Slurry P.C.B.		_____	_____	_____	_____			
AGA	Calibration		_____	_____	_____	_____			
Ambient Air Sampling	Pre-burn Burn Post-burn Analysis		_____	_____	_____	_____	_____	_____	
Feed-stock Feed Meter	Arranged Obtained Obtained	_____	_____		_____	_____			
JRN						_____			
Analyses Completed						_____	_____	_____	
Preliminary Report						_____	_____	_____	
Final Report							_____	_____	_____

Material Handling

A spill of PCB fuel or contaminated residues during transportation, handling or storage would present a potential for a health hazard and a general nuisance. Escape into a waterway, a channel or a ditch leading to a water body could result in damage to the water course, possible effects on wild life and would necessitate troublesome clean up procedures. Spills will basically be handled in accordance with the existing provincial and municipal arrangements, but additional arrangements have been developed to prevent any nuisance from being created. The arrangements at the supply and receiving locations are given on p. 5, the "in transit" arrangements are detailed below.

1. The carrier must dedicate one tank vehicle for the transportation of the fuel from the source to the St. Lawrence Cement Company. This vehicle must have a current certificate of mechanical fitness and be equipped with a radio.
2. Transportation of the fuel must be limited to major provincial highways and arterial roads to the St. Lawrence site, which must be approved by the Ministry.
3. The carrier must adhere strictly to the Gasoline Handling Act and the Gasoline Handling Code of Ontario, with particular regard to the driver's responsibility during the transfer of the fuel to and from the truck.

4. The carrier must advise the appropriate district office of the Ministry of the Environment three (3) days before the transfer of the following:
 - (i) time and duration of the entire transfer of fuel.
 - (ii) any alterations to the truck route.
 - (iii) license number of both tractor and trailer and any distinguishable insignia.
 - (iv) if not already known, to provide the physical, chemical composition of the fuel.
5. The carrier must advise the driver of the vehicle as to the type of material being transported and that Items 2 and 3 be strictly adhered to during the transfer operation.
6. Once the transfer has been completed, the carrier must have the truck and associated equipment thoroughly cleaned by rinsing with a solvent in which PCB's are readily soluble. The resultant rinsing solution will then be transferred to the St. Lawrence Cement on-site storage tanks to be used as a fuel.

Once the appropriate district office of the Ministry of the Environment has been notified of the details of the transfer, that office shall notify any other MOE office through whose region the transfer will occur and the duty officer(s) of the MOE.

As well, the district offices involved will contact the appropriate municipal authorities (e.g., regional municipality, fire departments, etc.) through which the transport of the fuel will occur and provide the necessary details.

A discussion has been held with the fuel supply contractor covering further details of route to be followed, communications and safety requirements. A summary of the meeting outcome is given in Appendix D. This appendix will be amended and updated as details are confirmed or modified in the light of future developments, further meetings and required changes.

On site storage of the fuel material shall be in tankage around which a structurally sound berm has been constructed and sized in accordance with the Gasoline Handling Act and Code. The valving and other equipment associated with the transfer and storage of the fuel shall be in a good state of repair. For the control of atmospheric emissions of PCBs, all vents shall be equipped with activated carbon canisters.

By conducting this test burn, some waste material will result, such as sample residues, carbon canisters, and possibly contaminated clothing and soils. This material will be handled by a competent contractor, who is acceptable to the MOE, for disposal in a secure landfill, designed and approved to accept such material.

Information Dissemination

The release of unchecked information, results of analyses, emission data, etc. must be subject to review before issue. Errors of fact and interpretation can arise from premature and partial disclosure.

Everyone concerned with this test is reminded of that fact and instructed that requests for information by persons other than those directly in need of them for operational purposes should be passed to the supervisor of the Technology Development and Appraisal Section, Dr. G. Van Volkenburgh or in his absence to Mr. T.W. Cross, Director of the Air Resources Branch.

The results of all tests and all records should therefore be forwarded to Dr. Van Volkenburgh as they become available, so that they can be made available for public information. Promises that information will be freely available must not be negated by this procedure, hence all information confirmed or unconfirmed must be forwarded with any necessary qualifications being indicated.

The intent is simply to ensure that the release of information is not clouded by the failure of an individual, under the pressure of other duties, to indicate any limitation or implication associated with the information.

TAGA 3000

The TAGA 3000 will operate only to analyse the stack emissions. It will be located close to the kiln exhaust duct on hard standing.

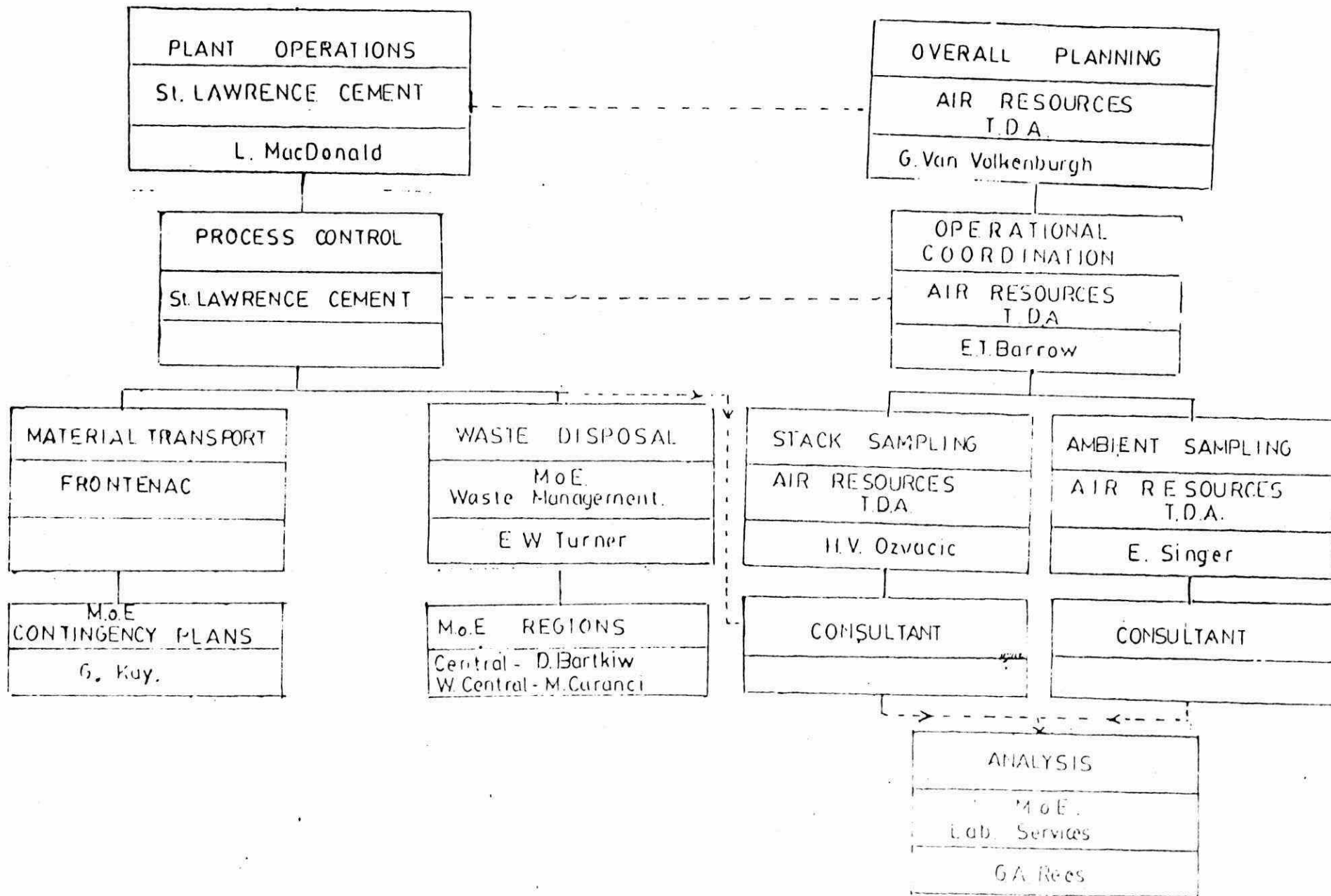
Before the test starts the TAGA will be placed in position and tests will be made to ensure that the sample probe and line to the TAGA do not influence the results in a manner which cannot be countered.

Measured quantities of PCB's will be injected into the sample probe by syringe, while the sample probe is drawing a sample of normal stack gas. The TAGA will be used to analyse the stream, the possibility that adsorption of PCB's onto the surfaces of the probe or lines could occur, and the degree of condensation of PCB's with moisture condensate from the cooled stack gas, will be examined.

During this trial and calibration run a maximum concentration of 1 ug/m^3 will be used and approximately 0.01 gm total of PCB's will be injected. Throughout the run and during the test burn the TAGA by-pass stream will be directed into a VENSORB system containing active carbon to remove the traces of PCB's present.

An application for a certificate of approval for the use of the TAGA and the injection of PCB's has been approved.

ORGANIZATIONAL STRUCTURE



PLANNING AND EMERGENCY CONTACTS

<u>Ministry of the Environment</u>	<u>Name</u>	<u>Phone</u>
Overall Planning	G. Van Volkenburgh	965-4081
Operational Coordinator	E.T. Barrow	965-1634
Contingency Planning	G. Kay	965-3237
St. Lawrence Cement	L. MacDonald	822-1653
Stack Sampling	V. Ozvacic	965-1634
Ambient Air Sampling	E. Singer	965-4081
Laboratory	G. Rees	248-3031
Waste Management	-----	965-9670
Central Region	D. Bartkiw	424-3000
West-Central Region	M. Caranci	(519) 623-2080
Frontenac C.W.S. Ltd., (New York)	W.M. Bates	(716) 773-2300
Frontenac C.W.S. Ltd., (Hamilton)	T. Ricciuto	(416) 545-4406

APPENDIX A

WORK STATEMENT

Title: Measurements of PCB and Hexachlorobenzene Emissions from
Cement Kiln #1 at the St. Lawrence Cement Plant in Clarkson

1. Purpose:

An experimental burn of industrial waste oils containing PCBs is scheduled for early October. The purpose of the program is to demonstrate that the resulting emissions of PCBs and hexachlorobenzene are very low and that the ambient air quality is not affected to any unacceptable degree. PCBs concentrations in the exhaust gases after the kiln precipitator will be monitored with a PCBs continuous monitor the TAGA 3000 designed and operated by Sciex Limited. Simultaneously and at almost the same location, conventional stack sampling will be performed in order to confirm the results obtained with the TAGA 3000 and measure the emissions of hexachlorobenzene. Additionally, stack sampling will be carried out on the clinker cooler stack at the same time as other stack sampling. Other groups will make in-plant process and ambient air quality measurements in the vicinity of the plant before, during, and after the test burn. MOE personnel will monitor the burn and directly supervise the various sampling groups. Guidelines for the conduct of the burn will be given to all parties.

2. Description of Process Exhausts:

In Kiln #1, cement clinker is produced by a wet process; a water slurry of raw materials is introduced into a rotary kiln at the far end, dried with hot combustion gases, and slowly transported toward the kiln's front end. The kiln is fired with pulverized coal and coke; measured quantities of waste oils will be injected into the flame at the front end. The hot clinker is cooled in the clinker coolers with ambient air, part of which is used to sustain combustion. The rest is passed through the gravel beds and the clinker cooler stack. Exhaust combustion gases from the kiln end are passed through electrostatic precipitators and emitted via the main stack.

3. Description of Sampling Sites and Stack Gas Conditions:

There are two kilns with electrostatic precipitators at the plant. Exit gases from both precipitators are transported through square ducts to a common exhaust fan and emitted via a 169 m stack. Only one of the two kilns, Kiln #1, is modified for burning of waste oils. Sampling of precipitator exit gases from Kiln #1 will be done at a nonideal location; there are only about 4.5 equivalent upstream and 1.8 equivalent downstream diameters of straight section of the duct measuring 1.4 x 1.98 m (4.7 x 6.5 ft) between the sampling ports and the two closest bends. There are 5 sampling ports on the vertical side of the duct installed about 8-10 m above the floor. Movable scaffolding with sufficient working room at the sampling location level is installed permanently. The velocity profile at the sampling site is skewed with individual point velocities ranging from about 13 m/sec (43 ft/sec) to 36 m/sec (118 ft/sec). Average stack gas temperature is about 215°C (420°F) with the maximum recorded at about 232°C (450°F). Stack gas moisture is about 35%. At 215°C particulate loadings range from .1129/m³ (.049 gr/ft³) to about .69 g/m³ (.3 gr/ft³) with the likely average at about .23 g/m³ (.1 gr/ft³). Similarly to previous sampling at this site, number of sampling points will be 40. Total sampling time per test will be 6 hours, although the test burn will be run on a 24 hour basis for one day in week #1, and two days in week #2.

Sampling of clinker cooler exhaust gases will be done on the stack which is about 22.5 m (74 ft) high and 1.83 m (6 ft.) in diameter. Sampling platforms and ports are installed at an almost ideal location. Stack gas temperature and velocity are about 60°C and 11.6 m/sec, respectively. Stack gas moisture is probably less than about 5%. Sampling will be done at 36 sampling points located on two horizontal traverses for a total of 6 hours.

4. Description of Sampling Trains:

Conventional EPA trains modified to include a florissil tube after the water impinger will be used to collect the samples

which will be analyzed for PCBs and hexachlorobenzene by gas chromatography. The train is similar, but not identical to the one described in the appended copy of the EPA draft method for determination of PCBs in combustion sources. The train will include filter in front of impingers; Teflon will be used to enclose the silicone rubber gasket in the filter holder assembly, and teflon sleeves will be used instead of greases usually applied to the ball joints of train glassware.

5. Description of Experimental Burn and Sampling Program:

The experimental burn is planned to last 3 days, during which extensive monitoring for PCBs will be done in the ambient air and the two kiln stacks. Ideally the first experimental day will be on Thursday of one of the first two weeks in October, 1979. Friday to Monday will be used for equipment debugging. The second period of two days will start on Monday or Tuesday. Two baseline tests are planned, one on the Wednesday of the first week or earlier and another on the Wednesday of the second week. If any of the tests on Thursday, Monday or Tuesday was unsuccessful it will be repeated on Wednesday and schedule revised accordingly.

During the experimental burn one test on the clinker cooler stack will be done each day. A total of four tests are required on the precipitator exit duct. Process stream samples will be collected at a frequency to be specified later in this work statement. Process conditions will be also collected throughout the testing period.

6. Detailed Work Statement:

6.1 Prior to field sampling it will be necessary to thoroughly clean the train components with chromic acid and pentane*, assemble the train, connect a cartridge with florisil to the inlet of the sampling probe, heat the probe and filter to the operating temperatures to be used in field sampling for about 15 minutes and sample the laboratory air for 4 hours. Train will be disassembled, all components washed with pentane and the

* Pesticide grade pentane of acceptable quality can be obtained from Caledon Labs, Georgetown.

pentane extracts sent to MOE laboratories for analysis. If these blank experiments show high PCBs levels the train will be modified and experiments repeated. These experiments should be done well in advance of the actual field sampling, probably in August, and repeated immediately before field sampling.

*Note: All Glass Fiber Filters will be Pre-extracted with Pentane.

6.2 Field Sampling:

As indicated in the appended draft method and in the work statement, analysis of trace quantities of PCBs in the combustion gases is difficult because of organic interferences. Therefore, great care should be exercised in preparation for sampling and clean up of the sampling train before and after sampling. Before sampling all sampling procedures planned to be employed in the field will be reviewed in detail with the Air Resources Branch.

Precipitator Exit Duct:

There will be four complete tests on the precipitator exit duct during the three days of experimental burn. Samples from two tests will be analysed by Gas Chromatography - Mass Spectrometry (GC-MS). Samples from the other two tests will be analysed by following a perchlorination procedure.

At present it is not certain what the PCBs concentrations in the duct gases will be, but the results from previous sampling indicate that they could be lower than 1 ug/m^3 (microgram per cubic meter).

6.3 Clinker Cooler Stack:

Only three tests will be done on this stack during the experimental burn. One of the three samples should be analysed by GC-MS.

6.4 Collection and Preparation of Process Samples:

These samples will be collected by St. Lawrence personnel at the frequency specified below. Compositing of the samples and extraction will be done by the stack sampling consultant. All extractions must be carried out with pentane only, using pre-cleaned apparatus, materials and glassware. All extracts as well as non-extracted samples will be sent to MOE laboratories.

Sample	Frequency of Collection	Sample Preparation
1. Feed Water	One sample per 8-Hr Shift	
2. Feed Solids	Three samples per 8-Hr Shift	
3. Feed Slurry	One sample per 8-Hr Shift Combine $\frac{1}{3}$ of each sample into one 24-hour composite sample. Retain the other half of the 8-hour samples.	Perform extraction on 24-hour composite sample only.
4. ESP Dust Return	One sample every 3 hours. Combine one half of each sample into one 24-hour composite sample. Retain the other half.	Perform extraction on 24-hour composite sample only.
5. ESP Dust Discord	One sample every 3 hours. Combine one half of each sample into one 24-hour composite sample. Retain the other half.	Perform extraction on 24-hour composite sample only.
6. Clinker	One sample every 2 hours. Combine one half of each sample into one 24-hour composite sample. Retain the other half.	Perform extraction on 24-hour composite sample only.
7. PCB Oil Feed	One sample every 2 hours. Combine one half of each sample into one composite sample. Retain the other half.	Perform extraction on 24-hour composite sample only.
8. PCB Truck Load	One sample from each of the 4 truck loads. Combine one-half of each sample into one composite sample. Retain the other half.	Perform extraction on the composite sample only.
9. Coal	Two samples per 8-hour shift. Combine into one 24-hour composite.	Perform extraction on 24-hour composite sample only.

Extraction procedures for these samples should be described in reasonable detail in the proposal.

6.5 Collection of Process Data

St. Lawrence personnel will be responsible for collection of all pertinent process data. Stack sampling consultant is expected to ensure that these data are taken and to incorporate the data into the stack sampling report.

7. Cost Proposal

The cost proposal should be itemized as follows:

1. Collection and preparation of stack samples
2. Compositing and extraction of process stream samples
3. Preparation of stack sampling report. First draft of the report should be completed by approximately the end of November. Analytical report will be obtained by November 15, 1979. Final report is to be completed by December 31, 1979.



Ontario

- 7 -

Ministry
of the
Environment

135 St. Clair Avenue West
Suite 1100
Toronto, Ontario
M5S 1P5

Air Resources Branch,
880 Bay Street,
4th Floor,
Toronto, Ontario.
M5S 1Z8

(416) 965-1634

July 12th, 1979.

Dear

Subject: Request for Proposal (RFP) for Stack Sampling
for Chlorinated Compounds at the St. Lawrence/
Mississauga Cement Plant

Enclosed please find a description of stack sampling and extraction procedures for PCBs and hexachlorobenzene from the collected samples, required in support of our study at the St. Lawrence Cement Plant in Clarkson in October of this year. You would be required to carry out stack sampling, weigh the particulate sample, extract PCBs and hexachlorobenzene from the stack samples, extract PCBs from the process stream samples, transport the extracts to the MOE Pesticide Laboratory, and write the final report after receiving the analytical report from the MOE Pesticide Laboratory. If you would like to carry out the work please submit a technical and cost proposal to:

Mr. V. Ozvacic,
Air Resources Branch,
880 Bay St., 4th Fl.,
Toronto, Ontario.
M5S 1Z8

Before 5p.m., August 11, 1979.

As is obvious from the enclosed work statement the successful bidder will be expected to perform some laboratory work in order to ensure a proper clean-up of the sampling equipment and removal of all interferences that could possibly be released in field sampling.

Because of the sensitive nature of the experiment and the limited duration of experimental burn the successful bidders are also expected to show that they will be able to complete the described work within the time frame indicated and ensure that contingent back-up in manpower and equipment will be available during the experimental burn.

If you have any questions regarding this RFP, please do not hesitate to contact Mr. John McDonald of the Source Assessment Unit.

Yours sincerely,

VO/MT

V. Ozvacic, P.Eng.,
Head, Source Assessment Unit,
Technology Development
& Appraisal Section,
Air Resources Branch.

ENCL.

APPENDIX B

FALL MISSISSAUGA SURVEY

Following identical technical procedures as developed in Phase I and utilized throughout Phase II, an intensive study consisting of sampling at eleven (11) specified sites in Mississauga for thirteen (13) consecutive days will be carried out. Components of the work assignment are as follows:

(1) PREPARATION OF CARTRIDGES:

Following previously defined procedures, the contractor shall prepare, prove, code and distribute 160 cartridges for use in Phase III. This includes a 10% excess to allow for blanks and breakage.

(2) SAMPLING BY CONTRACTOR AT 11 MISSISSAUGA SITES:

The contractor, via his subcontractor, shall undertake all Phase III sampling, i.e., 11 sites as specified by the Crown Representatives for 13 consecutive days for a total of 143 samples. All sampling will be carried out according to detailed specified procedures as utilized in Phase II, and samples will be delivered at least once in each 3 days to the laboratory.

(3) ANALYSIS OF SAMPLES:

All field samples (143) plus appropriate blanks, check samples and recovery samples will be analysed promptly by identical analytical procedures as developed in Phase I. All data will be subject to quality control audits, and will be made available to the Ministry on an ongoing basis. On request by MOE confirmatory analysis on a second GLC column will be provided.

(4) PROVISION OF SAMPLES TO M.O.E. FOR INDEPENDENT ANALYSIS:

As in Phase II, a portion of all samples will be provided to the Ministry in sealed glass ampoules. These will consist of pentane isolates following Florisil clean-up, and prior to the addition of iso-octane keeper.

(5) METEOROLOGICAL DATA REDUCTION:

For each day of the Mississauga intensive survey, the contractor will obtain hourly meteorological data (wind speed, direction and temperature) from one reporting source in reasonable proximity to the St. Lawrence Cement Plant in Mississauga. This daily data will be compared to a second Toronto area station (such as Malton or the Island Airport) to ensure consistency. The meteorological data will be reduced to daily wind roses for correlation with analytical results.

Concentrations of PCBs will be evaluated for the sampling periods before, during and after the PCB combustion trial. Background levels will be established at stations not downwind

of the St. Lawrence Cement plant and these will be statistically compared for the 3 periods of the intensive survey on the basis of mean and standard deviation. Data from sampling stations downwind of the plant will be compared to background levels to determine the significance of changes in the levels of PCBs.

(6) REPORTING:

An interim report will be submitted for approval of the Crown Representatives one week after the end of the field sampling program. The draft of the final report and the final report will be submitted within four weeks and ten weeks, respectively, after the last day of the survey.

(7) MEETINGS:

Throughout Phase III and, in particular, after submission of each report, technical and/or administrative meetings will be held with Ministry personnel to review all related aspects of the project.

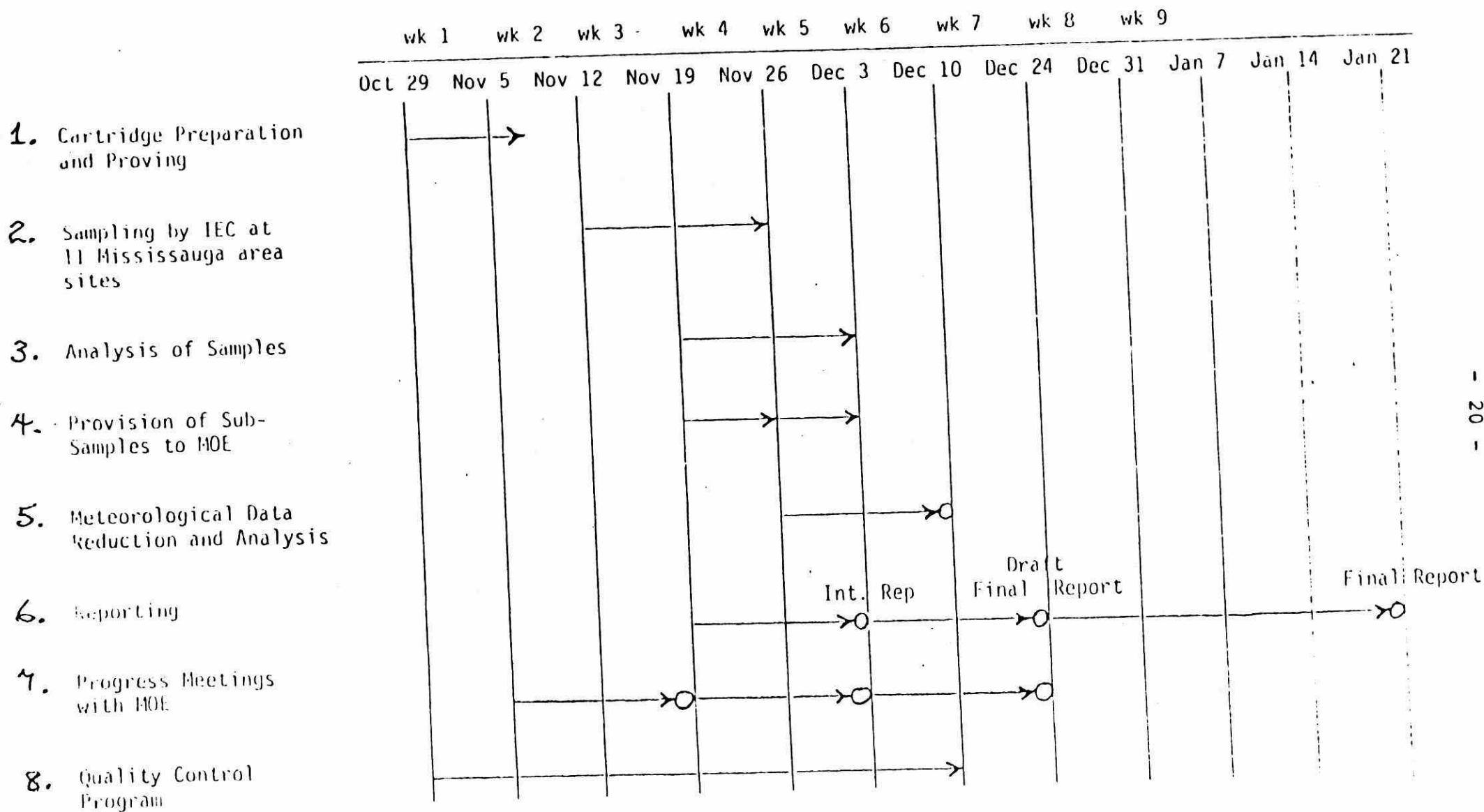
(8) QUALITY CONTROL PROGRAM:

An intensive quality control program as utilized in Phase II will be maintained throughout Phase III.

(9) WORK SCHEDULE:

The tentative work schedule for Phase III is attached.

TENTATIVE WORK SCHEDULE - PHASE III (1979)



NOTE : This tentative schedule assumes no overlap of technical lab time with Phases II and IV.
The schedule can be advanced if part of Phase II work is deferred.

APPENDIX C

St. Lawrence Cement Co.

PCB Ground Level Concentration

Basic Data:

Gas Flow/kiln	3,500 m ³ /min
Stack Height	157.5 m
Stack Temperature (assume)	230°C
Stack Diameter	3.96 m

At a <u>feed rate</u> for 20% PCB mixture of	4 gal/min.
PCB feed at a density of 12 lb/gal. =	9.6 lb/min.
=	72.6 gm sec.

At 99.99% destruction:

Emission of PCB	= 7.26 mg/sec.
Stack gas flow (2 kilns)	= 7000 m ³ /min.

Calculating by - Holland plume rise equation
and Pasquill-Gifford dispersion equation

Maximum ground level concentration occurs under A stability conditions at about 750 m distance

1/2 hour ground level concentration	= 7 ng/m ³
Stack gas concentration	= 63 µg/m ³

∴ at 99.996% destruction

Stack gas concentration =	$\frac{63 \times 0.004}{0.01}$	= 25 µg/m ³
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Ground level concentration	= 2.7 ng/m ³
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Suggest working to:

Stack gas	20 µg/m ³
GLC	2.5 ng/m ³

Circulation List

W.B. Drowley	Executive Director, Resources Division
T.W. Cross	Director, Air Resources Branch
L. Pitura	Director, Waste Management Branch
P. Isles	Waste Management Branch
N. Mulvaney	Director, Legal Services Branch
G. Rees	Laboratory Services Branch
M. Caranci	West Central - Cambridge
D. Bartkiw	Central Region
D. Ogner	Central Region
G. Van Volkenburgh	Technology Development and Appraisal Section
V. Ozvacic	" "
E. Singer	" "
E.T. Barrow	" "
L. MacDonald	St. Lawrence Cement
D. Pascoe	E.P.S.
B. French	SCIEX

APPENDIX D

ST. LAWRENCE CEMENT1.0 GENERAL

The transportation, handling and storage of PCB contaminated fuel required for the test burn at St. Lawrence Cement, Mississauga, appears in the eyes of the public to be as much a concern as the incineration of this material. In an attempt to address these concerns the protocol dated October 17, 1979, together with the notes of meetings three and four of the PCB Test Burn Liaison Committee, outlined the procedures which will be followed during the transportation, handling and storage of this fuel.

It is the purpose of this report to revise Appendix of the protocol to incorporate the input of the citizens through the liaison meetings and to any additional information obtained since the October, 1979 printing of the protocol.

The handling, transport and storage of the fuel containing PCB will be in accordance with the Gasoline Handling Act and Code.

Under this Act and Code this fuel is considered as a Class III product with flash points above 150°F and is considered the least flammable.

2.0 TRANSPORT2.1 GENERAL

The test burn will require 20,000 to 22,000 gallons of 10 percent by weight chlorine content fuel, which will be consumed over a ten day to two week period during 3 one-day burns. Because of the scheduling of the burn days, it is not necessary to have the entire quantity of PCB contaminated fuel

on-site at any one time. The delivery of the fuel could be such that two truck loads are delivered for the first day of the test burn and the additional three loads delivered after the initial burn. This would amount to an approximate maximum on-site quantity of 16,000 gallons which is roughly equivalent to 1,800 lbs of PCB's.

The tank truck proposed for use by Frontenac Chemical Waste Service is a dual rear axle stake body vacuum pumped tanker with a capacity of 4500 to 4700 imperial gallons. To provide the 20,000 to 22,000 gallons, five trips will be required since only one truck will be used.

There was considerable discussion by the committee as to whether a convoy of five vehicles with police escort or one vehicle making five trips is preferred. It was concluded that the latter was more acceptable for a number of reasons:

1. a convoy would attract more attention and, inherently, a greater potential for an accident;
2. in the event that an accident did occur, the potential quantity of PCB contaminated fuel spilled would be 20,000-22,00 gallons not 4500-4700 gallons;
3. five trucks would require decontamination with a five-fold quantity of rinse solvent requiring handling rather than if one truck is used;
4. scheduling the transport during acceptable weather and road conditions would be easier with one truck than with five trucks and five drivers.

The schedule for the transport of this fuel is so arranged to allow one delivery on any given day. This represents about 0.016 to 0.04 percent of the total traffic in the area much of which consists of tractor trailer tankers from Liquid Cargo Lines, Gulf Oil, and Power Tank Lines.

2.2 ROUTE

The PCB contaminated fuel will be blended at Canadian General Electric - Guelph and at Westinghouse Canada Limited - London for delivery to St. Lawrence Cement along a pre-determined route. Unless an unforeseen turn of events occurs

(1) Canadian General Electric - Guelph

The truck will use highway #7 to #6, to #401, to #6, to #403, to QEW, east on Royal Windsor Drive to Southdown Road, south on #2 to St. Lawrence Cement.

(2) Canadian Westinghouse - London

The truck will use Oxford and Clark Streets to highway #100, to #401, to #6, to #403, to QEW, east on Royal Windsor Drive to Southdown Road, south on #2 to St. Lawrence Cement.

2.3 NOTIFICATION

Prior to the delivery of each of the five truck loads of PCB containing fuel, the following notification procedures will be adhered to:

1. The fuel will arrive at St. Lawrence Cement Co., Mississauga only during the day shift (3:00 am to 3:00 p.m.), Monday to Friday.

2. As appropriate, Canadian General Electric and Westinghouse Canada, will notify the suitable district/regional office of the Ministry of the Environment 24 hours in advance of any transfer of fuel, along with the details such as time, any changes in the route, hauler, license number of both tractor and trailer, any distinguishing insignia, name of driver and any other pertinent information.
3. The Ministry of the Environment district/regional office receiving this information will forward the same to all other district or regional offices through whose area the route travels.
4. The Oakville district office will inform the contingency staffs of both the Regional Municipalities of Halton and Peel of all pertinent details of the transfer.
5. As well, the appropriate detachments of the OPP, Ministry of Transportation and Communications and duty officers of the Ministry will be informed by Waste Management Branch personnel of the transfer and the details.
6. The haulage company, Frontenac Chemical Waste Services, will contact the Peel Construction Co. concerning the transfer.

7. The director of the Waste Management Branch or his designate will phone the clerk of the City of Mississauga, and Mr. Don Clarkson of the Council of South Mississauga Community Associations (CSMCA) on the details of the transfer before its occurrence and after each truck has been successfully unloaded.

2.4 ESCORT

The tank truck delivering the fuel will be followed by two vehicles throughout the entire route for each transfer. One of the vehicles will be a pickup truck supplied by Frontenac Chemical Waste Services and manned by three of their employees who are knowledgeable in handling emergencies and spills especially involving PCB's. This vehicle will be supplied with sufficient equipment to provide an effective initial response to an emergency situation. The equipment will include fire extinguishers, vermiculite, shovels, sand, and fire blankets. In addition, the pickup truck will be provided with radio equipment which will be in contact throughout the entire route with either Laidlaw Transportation or Superior Sanitation communication centres.

A second followup vehicle will complete the three vehicle convoy. This will be a vehicle manned by an MOE employee who is also knowledgeable about emergency spills and the handling of PCB's. This vehicle will be supplied with communications equipment and a portable air sampler for analysis of air quality in the event of an accident.

2.5 STANDBY CONTINGENCIES

Besides giving the advance notification to various contingency groups, the haulage company, Frontenac Chemical Waste Services will have

1. an agreement with Peel Construction Co. for the availability of a front end loader, trucks and crew;
2. available two of their own vacuum trucks working out of their Hamilton office;
3. available one of their own vacuum trucks working out of their Oakville yard.

The City of Mississauga Fire Department has been provided with information on spill contingencies and PCB handling through meetings with the staff of the Ministry of the Environment, Contingency Planning Section.

As well, the road and weather conditions for the route will be assessed by the local MOE office prior to the delivery commencing and if either are unacceptable the shipment will be postponed to a more favourable time.

3.0 HANDLING AND STORAGE

3.1 GENERAL

For conducting the test burn up to five transfers will be completed resulting in approximately 16,000 gallons of contaminated PCB fuel being stored on-site for up to 10 days. According to The Gasoline Handling Code this liquid is considered as a Class III fuel since its flash point is

higher than 150°F. In comparison Gulf Oil, located less than a mile east of St. Lawrence Cement, has approximately 250 storage tanks containing 150 to 400 million gallons of Class I, II, and III fuel. Yet, the City of Mississauga has approved subdivisions east of the refinery and abutting of the property line less than 100 feet from storage tanks.

3.2 STORAGE TANK

The storage tank to be used has a total capacity of 55,000 gallons and is constructed of steel, with a brick and glass lining and outside protective coating. The tank stands alone, over 200 feet from the other fuel storage tanks and over 500 feet from the kilns and operating floor. The unloading area is bermed on three sides with the unloading and transfer pumps also being dyked by a concrete curb with a sump for collecting any spillage.

3.3 UNLOADING

The unloading operation will occur up to five times with a maximum volume of 4,700 gallons per transfer.. Two transfers will be completed prior to the first test burn day, and up to three more before the final test burning.

The transfer will be conducted in accordance with The Gasoline Handling Code, Sections 5 and 6. In addition, Ministry of the Environment staff will be present to oversee the entire transfer operation for each load received to ensure that all contingencies requirements are in place and implemented if necessary.

3.4 SAFETY PROCEDURES

A number of safety features are present in the storage/handling system. However, these will be augmented during the transfer and test burn.

3.4.1 Fire Protection

The storage tank in question is within 200 feet of a fire hydrant which is part of the St. Lawrence Cement water system supplied by Lake Ontario water. The water system of the company has a standby diesel generator to provide water, in sufficient quantities for a fire emergency, in the event of a hydro-electric failure.

In addition, within 100 feet of the storage tank is the company's foam fire fighting facility. This system has sufficient capacity to handle the fire requirements of 250,000 gallons of fuel which is the capacity of each of the waste oil tanks. The foam system is provided with an outside nozzle/connection which will be available for firefighting at the PCB storage tank.

For the duration of the test burn period commencing with the arrival of the first load of fuel the following additional procedures will be implemented.

- a. A fire hose will always be connected to the water hydrant south of the tank, and tested daily for satisfactory operation.
- b. A fire hose will always be connected to the outside connective of the foam system, and tested prior to the first delivery for satisfactory operation.

- c. Additional vermiculite, fire extinguishers, shovels, etc. will be stored in the foam house or nearby.
- d. Both fire hoses will be manned during each transfer operation.
- e. A trained employee equipped with a fire extinguisher will be present at the unloading area during each transfer.

3.4.2 Surface Water Runoff

The surface ditch south of the PCB contaminated fuel tank and access road which drains the immediate area will be dyked at a point about 125 feet east of the centre line of the tank. If a spill occurs and enters the surface ditch it will be contained and permit more efficient clean up operation in a confined area.

3.4.3 Storage Tank - Connecting Lines

Prior to the delivery of fuel all lines, connections, pumps and safety valves will be refitted and checked. All open drain lines, approximately six, will be blank flanged and tested. The air vent from the tank to the atmosphere passes through three (3) absorbent vessels. The first two are usually filled with sodium hydroxide (caustic) for removal of chlorine and the third with activated carbon. For the test burn only the third vessel will be used since caustic will not react with biphenyls or chlorinated benzene compounds to remove chlorine. This will reduce the volume of waste requiring disposal. The activated

carbon after the test burn will be handled and transported, in accordance with Environment Canada's PCB Handbook dated March, 1979, to Newco in Niagara Falls, New York for disposal in an approved secure landfill.

The feed line from the storage tank to the kiln is manifolded with shutoff valves at the kiln floor in the immediate area of the operators control panel. This will allow for the ceasing of the PCB fuel feed immediately, if necessary.

3.5 Fire Department

On February 5, 1980, Mr. C.I. Hare, Chief Inspector of the City of Mississauga Fire Department was contacted by the Waste Management Branch regarding information relating to car/truck accidents which resulted in fires in this area of south Mississauga.

Mr. Hare indicated he could not recall any occurrences of this type within the last four years. In fact, it was his opinion that there are less calls for vehicle fires in that area than any other in Mississauga. A reason suggested by Mr. Hare for this fact, was the high truck volume with a corresponding low car volume, and that trucks generally burn diesel fuel which is less flammable, and combusts on pressure not temperature as in car gasoline engines.

Characteristics of Materials

- | | |
|---------------------------------------|--|
| 1. Askarels | -non flammable
-synthetic electrical insulating
(dielectric) material which when
decomposed by the electric arc
evolves only nonexplosive gases or
gaseous mixtures |
| 2. *Trichlorobenzene | -combustible
-flashpoint 210°F |
| 3. Tetrachlorobenzene
(1, 2, 3, 4) | -combustible |
| 4. Tetrachlorobenzene
(1, 2, 4, 5) | -combustible
-flash point 311°F |
| 5. Mineral Oil | -non recorded |
| 6. Transformer Oil | -non flammable
-combustible
-flash points 250°F-300°F |

* -is used as a dielectric, (1, 2, 4, 5) is not

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